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(71) Applicant IMI Santon Limited (United Kingdom), Sommerton Works, Newport, Gwent NPT 0XU

(72) Inventor Harold Insley
(74) Agent and/or Address for Service Christopher J. Sykes, Patents & Licensing Department, IMI Plc, PO Box 216, Birmingham B6 7BA

(54) **Whirlpool spa heating arrangement and heater therefor**

(57) An electrical flow heater 10 for a whirlpool spa bath wherein the bath water is recirculated past the flow heater 10 to maintain the bath water temperature. The flow heater 10 has a metal sheathed element 15 extending from a base plate 11 and associated with two temperature sensors, the first sensor 21 being beyond the end of the element 15 in the flow direction and the second sensor 22 being in thermal contact with the sheath of the element 15. The downstream sensor 21 is used to control the electrical input to the element 15 whilst the signal from the second sensor 22 is used to cut off power to the element 15 should the temperature of the sheath rise above a predetermined value e.g. in the absence of water.

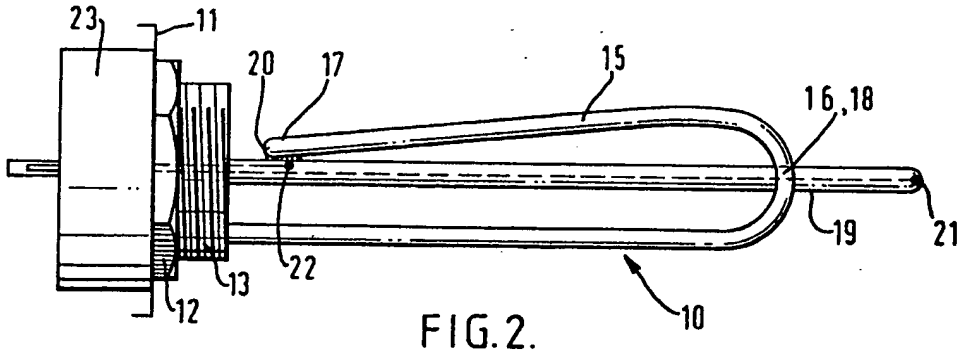


FIG. 2.

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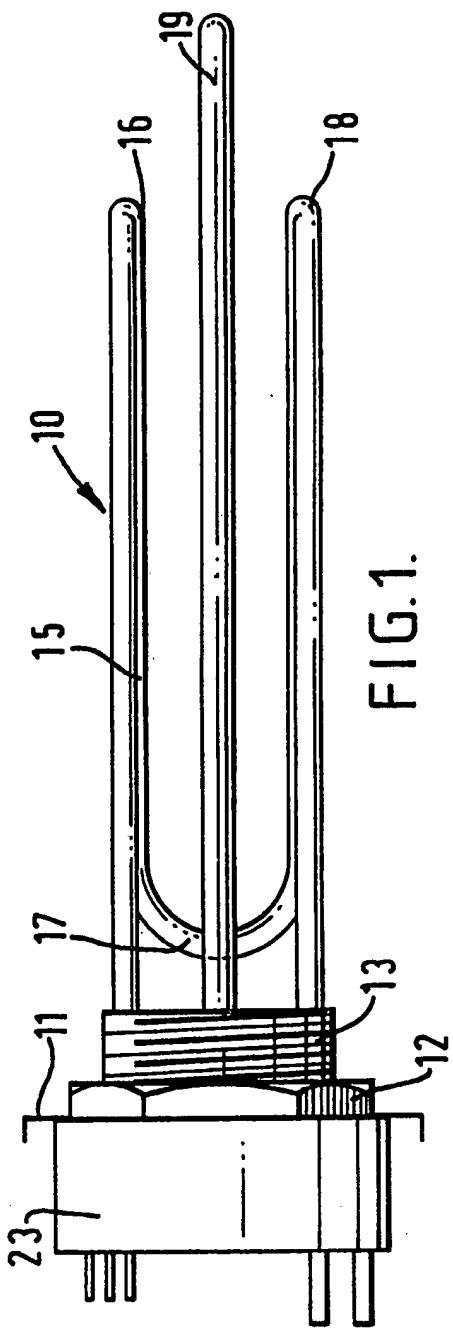


FIG.1.

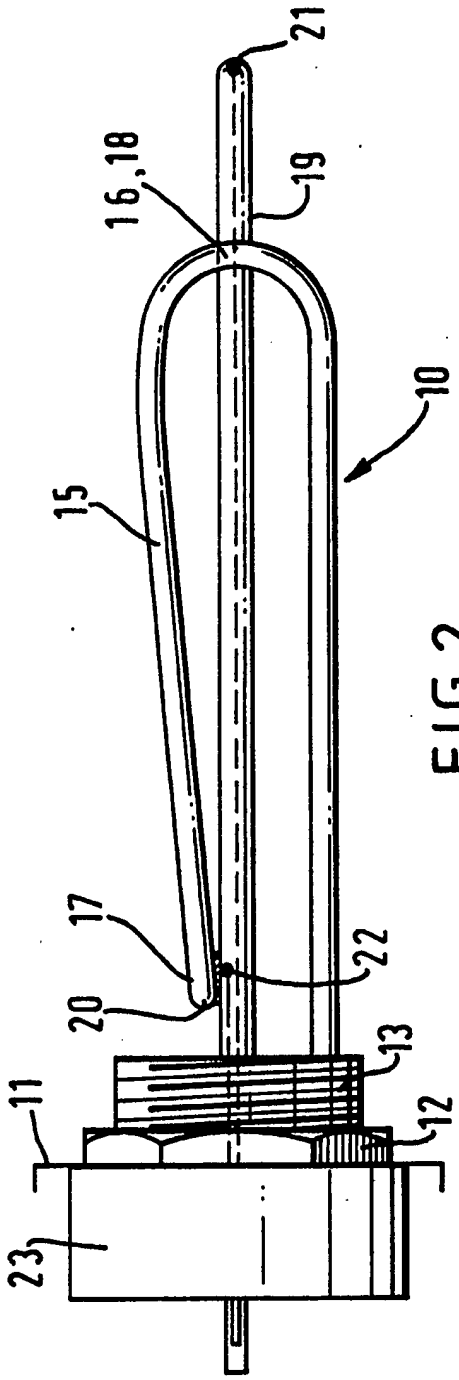


FIG.2.

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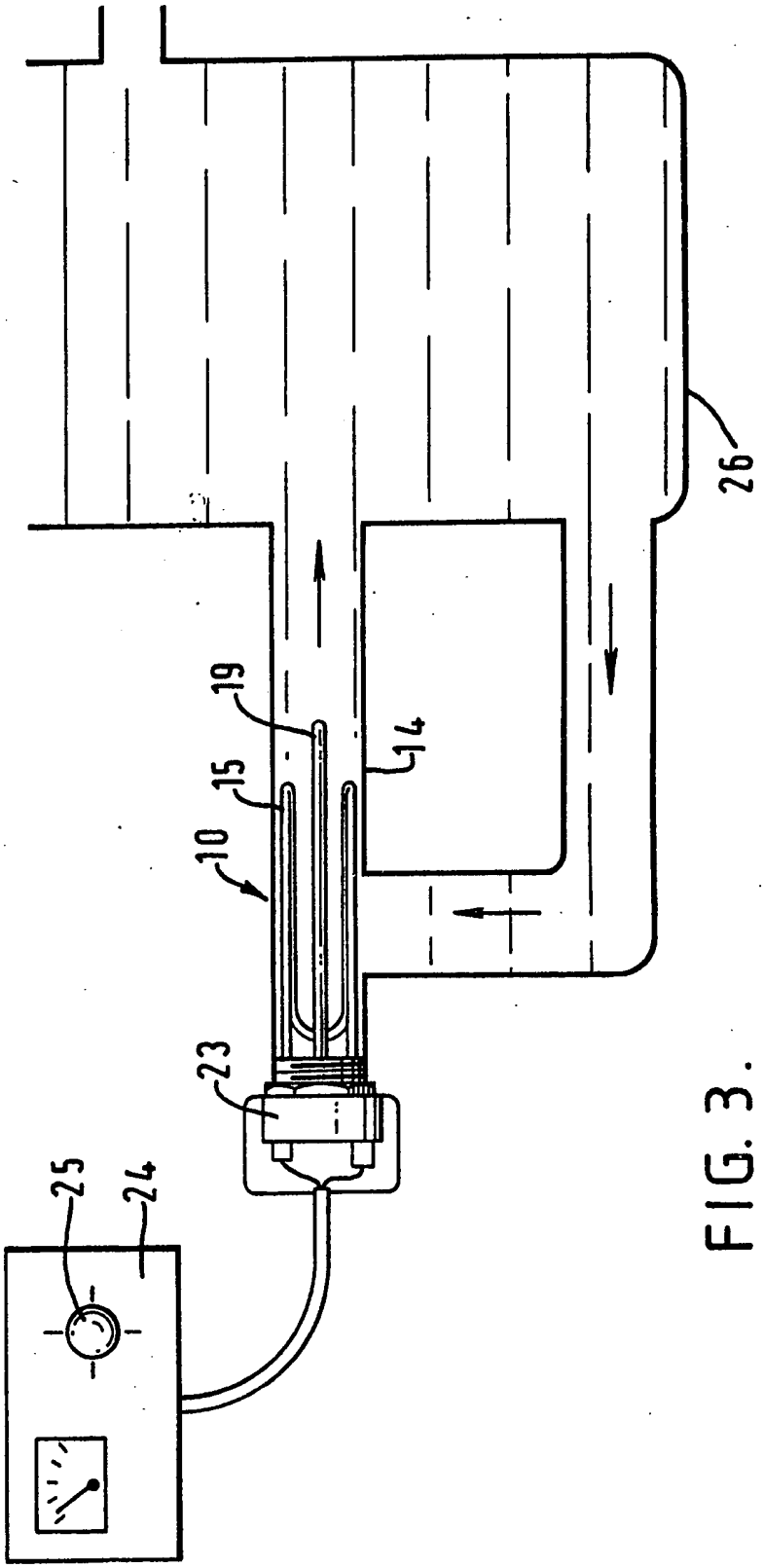


FIG. 3.

SPECIFICATION

**Whirlpool spa heating arrangement and heater therefor**

This invention relates to a whirlpool spa heating arrangement and a heater therefor.

Whirlpool spas are currently sold in the United Kingdom under various trade names including "Jacuzzi". They generally comprise a spa bath together with an associated recirculatory system which provides jets of water having bubbles of air entrained therein, which jets impinge on the occupant(s) of the bath. This is reputed to have some therapeutic effect on the occupant(s), but baths may also be taken solely for pleasure.

The spa bath is normally filled with heated water immediately prior to use. The pumping arrangement and the bubble entrainment device are then set in operation, and the occupant(s) is/are immersed in the water in the bath. Various salts or additives are commonly added to the water for therapeutic or hygienic purposes.

During use of the whirlpool spa, the water temperature will tend to drop, because of the heat losses from the bath. It is impractical to provide a heater in the bath itself and it could also be extremely dangerous. Such a heater is normally only required to compensate for heat losses from the bath in use.

According to one aspect of the present invention, we provide an electrical heater suitable for heating flowing liquid, said heater comprising a base plate, a continuous metal sheathed heating element in use extending from the base plate into the liquid to be heated, a first temperature sensor located beyond the heating element in a direction away from the base plate, and a second temperature sensor located intermediate the base plate and the first sensor, said second sensor being in thermal contact with the sheath of the element.

Both temperature sensors are preferably positioned within a single pocket which extends from the base plate, the thermal contact for the second sensor being provided by brazing the element sheath to the pocket.

According to a second aspect of the invention, we provide a whirlpool spa heating arrangement comprising an electrical heater as defined above, means for circulating liquid from an associated spa bath via said electrical heater and then returning it to the spa bath.

The heating arrangement preferably includes an electrical control circuit responsive to signals from said temperature sensors. Said control circuit may be adapted to control the power input to the heating element so as to maintain the temperature of the liquid adjacent the first sensor at a predetermined substantially constant temperature. Said control circuit may also include means for cutting off power to the heating element in response to the second temperature sensor reaching a specified temperature, typically a higher temperature than the liquid temperature previously referred to.

The control circuit may be mounted on the reverse side of the heater base plate from the element, and may be covered by a water-tight cover. Typically the control circuit is encapsulated in plastics resin material. The arrangement may also include a variable resistor or potentiometer connected to the control circuit but located separately from the heater. Such resistor or potentiometer may be provided with a manual control and an indicator such that the predetermined setting to the first sensor can be varied by the user. The manual control is typically provided on a panel accessible to the user but placed at an electrically safe distance from the whirlpool spa, eg several feet away.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a heater according to the invention,

Figure 2 is a second side elevation of the heater of Figure 1, and

Figure 3 is a schematic view of a whirlpool spa heating arrangement according to the invention incorporating the heater shown in Figures 1 and 2.

An electrical heater 10 has a base plate 11 which is integral with a nut 12 and threaded projection 13 to provide means for mounting heater 10 in a flow conduit 14. A metal sheathed electrical element 15, of the type commonly used in immersion heaters, extends from the base plate 11 through nut 12 and threaded projection 13 into said flow conduit 14. The particular metal chosen for the sheath depends on the nature of the liquid to be heated and it may be necessary to select a stainless steel or other special alloy dependent upon the particular conditions.

Element 15 is continuous and initially extends longitudinally away from base plate 11, turning back towards base plate 11 at a first U bend 16. Before reaching threaded projection 13, element 15 once again turns through a second U bend 17, the second U bend 17 being in a plane perpendicular to the first U bend 16. Element 15 then once again extends away from base plate 11 before turning a third U bend 18 and returning to base plate 11. First and third U bends 16 and 18 are at the same distance from base plate 11 and represent the furthest extent of element 15 from base plate 11.

A metal pocket 19 extends longitudinally from the centre of base plate 11 in the same direction as element 15 but pocket 19 extends beyond the first and third U bends 16, 18 of element 15 to a position where the heat emitted from U bends 16, 18 has no immediate influence on the temperature at the closed tip of pocket 19. The sheath of element 15 on the second U bend 17 of element 15 is brazed to the pocket 19 to provide thermal contact therebetween at a position 20 intermediate the tip of the pocket 19 and the base plate 11. The position 20 of the braze is generally closer to base plate 11 than to the tip of pocket 19.

Pocket 19 houses two temperature sensors

(shown in Figure 2), a first sensor 21 at its tip and a second sensor 22 at the point where the second U bend 17 of element 11 is brazed to pocket 19. Sensors 21, 22 have respective connections indicated by dashed lines within pocket 19 (see Figure 2) which pass through base plate 11 and connect with a control circuit 23 which is mounted on the reverse side of base plate 11 from element 15. Control circuit 23 is encapsulated in plastics resin material and operates in response to signals from sensors 21, 22.

Heater 10 is installed in flow conduit 14 which forms part of a liquid circulating system for a spa bath 26 (see Figure 3). Liquid is drawn from the bottom portion of the spa bath 26 past heater 10 in a direction away from base plate 11 and returned at a higher temperature to spa bath 26. The necessary pump and aeration device are not shown in the drawings. Heater 10 has a powder rating sufficient to maintain the temperature of liquid in spa bath 26 at its original level. The rating is typically 1 to 2 KW for a small whirlpool spa.

The temperature measured by first sensor 21 is that of the liquid after heating by element 15, and it should be noted that first sensor 21 is downstream of element 15. Control circuit 23 normally controls the operation of heater 10 so as to try to maintain the liquid temperature measured by first sensor 21 at a constant value. If however, for any reason, heater 10 is left on whilst flow conduit 14 becomes drained of liquid, or if fluid flow ceases and there is a failure of that part of control circuit 23 controlling element 15 in response to signals from first sensor 21, the temperature of the sheath of element 15 will rise. Control circuit 23 is operative to cut off the power supply to element 15 if the second sensor 22, at the position where element 15 is brazed to pocket 19, detects a temperature above a predetermined level. The control circuit is normally adjusted such that the normal liquid temperature after heating is controlled via first sensor 21 at about 40°C, and the power supply is cut off if the temperature of the second sensor 22 rises to 80°C.

A variable resistor or potentiometer (not shown) is connected to control circuit 23 but located at a distance from heater 10, and is incorporated in a control panel 24, which has a manual control 25, which together with an indicator can be used to alter the predetermined temperature setting about which first sensor 21 is used to control the power input to element 15. This enables the user to adjust the degree of "top-up" heat to the whirlpool spa, but does not in any way affect the operation of that part of the control circuit 23 which is dependent on the temperature of second sensor 22.

CLAIMS

1. An electrical heater suitable for heating flowing liquid, said heater comprising a base plate, a continuous metal sheathed heating element in use extending from the base plate into the liquid to be heated, a first temperature sensor located beyond the heating element in a direction away from the base plate, and a second temperature sensor located intermediate the base plate and the first sensor, said second sensor being in thermal contact with the sheath of the element.

2. A heater as claimed in Claim 1 wherein both temperature sensors are positioned within a pocket which extends from the base plate in the same direction as the heating element.

3. A whirlpool spa heating arrangement comprising a heater as claimed in Claim 1 or Claim 2, means for circulating liquid from an associated spa bath via said heater and returning the liquid to the spa bath.

4. A heating arrangement as claimed in Claim 3 including an electrical control circuit responsive to signals from said temperature sensors.

5. A heating arrangement as claimed in Claim 4 wherein the control circuit is adapted to control the power input to the heating element so as to maintain the temperature of the liquid adjacent the first sensor at a predetermined substantially constant temperature.

6. A heating arrangement as claimed in Claim 5 including means for cutting off power to the heating element in response to the second temperature sensor reaching a specified temperature.

7. A heating arrangement as claimed in any of Claims 4—6 in which the control circuit is mounted on the reverse side of the heater base plate from the element.

8. A heating arrangement as claimed in Claims 4—7 including a variable resistor or potentiometer connected to the control circuit but located separately from the heater.

9. A heating arrangement as claimed in Claim 8 wherein the resistor or potentiometer is manually variable and is provided on a panel accessible to the user placed at an electrically safe distance from the whirlpool spa.

10. An electrical heater as hereinbefore described with reference to and as shown in the accompanying drawings.

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